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Education's Greatest Untapped Resource: Second Career Scientists and Engineers

"The failing grade we earn, as a nation, in precollege science and math education has become a problem of substantial proportion. It is a concern that must be addressed now to insure that there will be future generations of scientists and engineers to carry on America's tradition of scientific and technological excellence. We will need eminently qualified people to do research at our national laboratories. We will need the best trained people to teach in the science and engineering disciplines at our universities and to conduct research there. But to accomplish this, we will need first to increase dramatically the number and quality of science and math teachers throughout our K-12 school systems. We will need to raise the level of technological literacy in our nation's workforce."

Chairman's Report to the Committee on Science and Technology, House of Representatives, Ninety-Ninth Congress, Second Session, November 1, 1986.

National Executive Service Corps

EDUCATION'S GREATEST UNTAPPED RESOURCE:

SECOND CAREER SCIENTISTS AND ENGINEERS

National Executive Service Corps
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New York, New York 10017

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Sponsored by Carnegie Corporation of New York

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EXECUTIVE SUMMARY

At a time when the nation is alarmed over the shortage of qualified science and mathematics teachers in public schools, the National Executive Service Corps (NESC) has discovered an untapped reserve: an ever-abundant supply of technical professionals nearing retirement who have expressed willingness to teach.

From years of experience with retired executives, NESC recognized that a valid and sustaining solution to the problem might be found in developing a plan, in cooperation with industry and the military, to encourage qualified professionals to enter the teaching profession as a post-retirement career.

Thousands of scientific and technically trained professionals annually reach retirement age ... but it was not known to what extent they would be interested in teaching as a second career. Nor was it known what factors might encourage or discourage their entering the profession. Prior to committing to an operational strategy, NESC determined that a feasibility study was needed to answer these questions. In April 1986, Carnegie Corporation of New York awarded NESC a grant for such a study.

With the help of the Educational Testing Service (ETS), more than 7500 individuals in seven leading corporations and in the U.S. Army and the U.S. Navy were surveyed. More than 4300 responses were received and analyzed, an impressive return rate of 64% for the military and 56% for industry.

The data gathered from the employee survey are impressive:

- All respondents have at least one degree in a technical discipline .... close to half have advanced degrees .... over seven percent have doctorates.
- One-third of industry respondents stated a positive interest in a post-retirement teaching career .... 53% had considered a teaching career ... 75% are willing to prepare if allowed time.

- Military respondents were even more positive ... 41% expressed definite interest in post-retirement teaching ... 75% had considered teaching .... 76% are willing to prepare if allowed time.

- An additional 38% of each group of respondents, although not yet fully committed, were willing to consider the possibility .... only 28% showed no interest.

- Most who said "yes" to exploring a teaching career have already had some form of teaching experience .... about 60% of industry and 75% of military respondents have already taught for two or more years .... about three percent are already certified to teach in some state.

- Industry respondents typically contemplate a second career of about five or more years .... while those from the military, being younger, expect to pursue a second career for 13 or more years.

- Attitudes toward the teaching profession are highly positive. While three-fourths would be willing to do whatever is necessary to meet certification requirements if given release time, most would be more likely to enter teaching if the certification requirements were eased.

The availability of employed professionals interested in teaching was but one factor to be considered. The attitudes of their employers .... the responsiveness and flexibility of academicians .... the views of teachers' organizations and regulatory bodies for certifying teachers .... all needed to be considered. Numerous meetings and discussions were held with representatives of these groups. NESC simultaneously surveyed 166 district school superintendents in locations adjacent to eight industry facilities to determine their needs and receptivity to our program. Forty-two percent responded, providing rich and important data.

Findings from these activities are equally significant.

- Sixty-five out of 70 district school administrators indicated considerable interest in and support for the NESC strategy. Six of eight industry locations anticipate a need for math and science teachers over the next five years.

- Recognizing the urgent national problem, both military and corporate employers are supportive of the proposal for preparing their employees to pursue post-retirement careers in teaching. There are some obstacles .... such as released time for student teaching .... but most are optimistic these can be overcome.

- Institutions for preparing teachers, as well as accrediting bodies, while insisting on preserving their high standards, are receptive to considering alternative programs for second career teacher candidates.

The results of our nine-month study, based on data and not merely beliefs, confirm the availability of a substantial group of well-educated and highly experienced professionals who are potentially strong and viable teacher candidates. The avid interest of industry and military leadership in supporting post-retirement teaching is of significance, confirming our belief in the proposed strategy. Of equal importance, the acceptance by the education establishment assures an environment conducive to the professional development and eventual placement of teacher-candidates in the nation's school systems.

All the ingredients for success seem to be at hand. Our task now remains to turn strategies into plans and plans into action. A means must be developed by which the transition from industry and military employment to the classroom can be smoothly achieved at both the policy and program levels.

A national collaborative effort is required to provide a long-term solution to this serious shortage. American industry and the military are urged to adopt a post-retirement teacher option policy and institutionalize a mechanism for its implementation. Educators nationwide need to make available compressed and innovative teacher training programs. State legislators and policy makers are urged to initiate alternative qualification programs. Teacher organizations are encouraged to embrace this accelerated induction process for experienced and knowledgeable aspirants. These actions will generate an annual stream of qualified science and mathematics teachers so desperately needed.

Now there is a way to raise the level of technological literacy in our nation's workforce and the armed services. It is up to all of us to make it happen.

In all this activity, NESC has been guided by an outstanding Math/Science Advisory Council. The names of these concerned citizens, who have given of their time and counsel follow.

MATH/SCIENCE ADVISORY COUNCIL:

Dr. Gregory R. Anrig, President
Educational Testing Services
Princeton, New Jersey

Dr. William O. Baker
Retired Chairman
AT&T Bell Laboratories
Murray Hill, New Jersey

Mr. John Diebold, Chairman
The Diebold Group, Inc.
New York, New York

Dr. Norman C. Francis, President
Xavier University
New Orleans, Louisiana

Senator John Glenn, U.S. Senator, Ohio
Washington, D.C.

Frank Pace, Jr., Chairman
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Nathan Quinones, Chancellor
New York City Board of Education
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Dr. Simon Ramo, Director Emeritus
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General Bernard A. Schriever, USAF (Ret.)
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Lawrence Hall of Science, University of California
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Dr. Robert C. Seamans, Professor Emeritus
Massachusetts Institute of Technology
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Albert Shanker, President
American Federation of Teachers
New York, New York

Dr. P. Michael Timpane, President
Teachers College, Columbia University
New York, New York

Admiral James D. Watkins, U.S. Navy (Ret.)
Washington, D.C.

Dr. Blenda J. Wilson, Executive Director
Colorado Commission on Higher Education
Denver, Colorado

BACKGROUND

A seemingly intractable problem in American education is the gap between the demand for and the supply of qualified science and mathematics teachers in our public schools.

There have been many concerned institutions and considerable action directed at solving this problem. As far back as the late 1950's, reflecting the concern about American education generated by the launching of Sputnik, The Ford Foundation funded a Master of Arts in Teaching program which sought to attract outstanding students into teaching and to improve the manner in which they were trained. This program was considered successful in terms of its graduates who entered teaching; however, only a few of the original programs still exist. Most were discontinued after foundation funding was exhausted.

As part of a general trend to increase instruction in science and mathematics, 41 states have increased the number of such courses required for high school graduation. Projections indicate that for each additional year of study required in either of these disciplines, there will be a demand for 34,000 additional high school teachers. Yet in 1981, only 1.3% of all graduates in education had majored in science or mathematics. A survey by the National Science Teachers Association (NSTA) reported that close to 18,000 science and mathematics teachers left teaching positions in 1982-83, a figure more than 12 times the number of bachelor's degrees granted in mathematics and science education the year before. As a result of these trends, a shortage of qualified teachers can be expected in all states.

In the near term, efforts to address this shortage will be adversely affected by the establishment of higher standards for entrance into the teaching profession and by restrictions on the use of non-certified personnel. Both the American Federation of

Teachers (AFT) and the National Education Association (NEA) are concerned about the quality of our nation's teachers. The AFT has publicly stated that 50% of the mathematics and science teachers are not qualified in the subject matter. The NEA has called for a halt to hiring uncertified teachers. The Carnegie Forum on Education and the Economy reported that as demand rises faster than supply, many states and districts are ignoring the standards already in place as they seek to staff their classrooms. When standards are ignored in order to fill vacancies, the public is mislead into believing that things are getting better when in fact they might be getting worse. This is the case when students are made to take more demanding academic courses without enough teachers qualified to teach them.

Over the long term, however, a number of important recommendations ought to strengthen the teaching of mathematics and science. For example, reports issued by the Holmes Group and the Carnegie Forum call for the restructuring of the teaching profession and of teacher education. They advocate abolishing undergraduate teacher education programs and reconceptualizing schooling to provide a professional environment for teaching.

Many states have already instituted special programs to attract non-traditional teacher candidates into such critical subject areas as mathematics and science. New Jersey, California and fourteen other states have developed special programs to provide individuals without prior teacher training, alternate routes to the classroom and to certification.

There are also a number of special science and mathematics teacher education programs springing up throughout the country. Some are non-traditional, a few are aimed at mid-career professionals and some at a much younger population such as Peace Corp returnees. Very few focus on retirees. The problem with these varied approaches is that, while all are noble in intention, they each generate so few certified teachers that they have little impact on the overall shortage throughout the nation. Most also suffer from a dependency on direct foundation, government or corporate funding which is neither continuous nor open-ended.

THE NESC APPROACH

The eventual resolution of this problem will depend on corrective actions that are taken on a broad front and are sustaining. Among them is a reassessment of teacher education as well as salaries and other inducements to encourage capable young people to enter and remain in public school teaching. However, such corrective actions, by their very nature, will only be partially effective. The demand for qualified science and mathematics teachers will exceed the supply for the foreseeable future regardless of the improvements. NESC perceived that a more strategic and sustaining solution to the problem might be found in developing a plan, in collaboration with industry and the military, to encourage qualified technical professionals to enter the teaching profession as a post-retirement second career.

The following major recommendation from a 1983 report "A Nation at Risk" by Secretary of Education T.H. Bell's National Commission on Excellence in Education, is at the heart of NESC's approach:

> "Substantial non-school personnel resources should be employed to help solve the immediate problem of the shortage of mathematics and science teachers. Qualified individuals including ..... industrial and retired scientists could, with appropriate preparation, immediately begin teaching in these fields."

In April 1986, as part of its overall effort to stimulate sweeping changes in the teaching profession, Carnegie Corporation of New York awarded a grant to the National Executive Service Corps (NESC) to test the feasibility of its proposed solution to the problem. NESC was able to draw upon substantial experience. As a nonprofit management consulting organization, NESC has for a decade recruited retired men and women with extensive corporate and professional experience to volunteer on consulting assignments for public benefit, often in the field of education.

In this instance, NESC proposed to develop a plan whereby technically educated and trained individuals in the military and industry might be recruited to serve as science

and mathematics teachers at the time of their retirement. The idea is to develop programs that provide opportunities for such interested and qualified people to take required education courses and to complete their practice teaching while still employed so they can become qualified to teach by the time they retire from their primary careers.

Among the issues that NESC proposed to study were:

- The proportion of technically trained employees who might be interested in public school teaching as a second career;
- Whether the background training and experience of these individuals would qualify them as viable teacher candidates;
- The length of service that might reasonably be expected of those who might consider teaching as a post-retirement career;
- Financial and other considerations that would encourage or discourage entering the teaching profession;
- Employer attitudes and policies that might encourage or impede preparation for post-retirement career teaching; and
- The extent to which educational, institutional and regulatory bodies would be willing to cooperate to expedite the entrance of such scientific and engineering personnel into the teaching profession.

Since last April, NESC has undertaken a multi-faceted effort, literally involving thousands of people. From the outset, NESC recognized that the availability of employed professionals interested in teaching was only one factor to be considered. The attitudes of their employers was also an important factor, as well as the response of people at teacher training institutions. The latter might have to revise their programs to accommodate teacher candidates who, although qualified in their subject area, did not yet have the requisite pedagogy for classroom teaching. Teachers' organizations and regulatory bodies for certifying teachers also needed to be consulted to establish a strategy that would be both practical and supportive. In addition, we needed to survey school administrators to see if local school districts had a need and an interest in hiring these types of people.

In collaboration with the Educational Testing Service (ETS), a non-profit testing and research organization, an eight-page questionnaire was developed to assess the level of interest of men and women in post-retirement teaching careers. Those to be surveyed in industry were individuals 45 years of age or older who had earned a technical degree; in the military, the inquiry was focused on those who had a technical degree and who were within three years of eligible retirement.
More than 7500 questionnaires were sent to such people in seven leading corporations* and in the Army and in the Navy. An impressive 64% of the people replied. In all, more than 4300 responses were received and analyzed.

While the employee survey was being conducted, far-ranging discussions were held with top corporate leaders and high ranking officers in the Departments of the Army, Navy, and Defense. At the same time, meetings were held with leaders in teacher training institutions and regulatory bodies that control teacher certification.

As indicated by the discussions in Chapters I and II, corporate management and military leaders show a predisposition to aid rather than impede those who want to pursue teaching as a post-retirement career... without going so far as to actively promote early retirement of their employees.

Chapter III presents a detailed analysis of the survey of industry and military personnel both with respect to methodology and resulting findings.

NESC simultaneously surveyed 166 district superintendents to determine their receptivity to our program. Forty-two percent responded. Views of teacher organizations were also solicited. Ways to expedite the transition from industry and military employment into the classroom were explored with school administrators and representatives of teacher training institutions, with generally favorable results. All these are discussed in Chapters IV and V of this report.

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* Combustion Engineering, DuPont, General Dynamics, G. E., IBM, Pfizer, and TRW.

Calls were made on nine corporate leaders to discuss the problem of insufficient and inadequate mathematics and science teachers and how it affected American industry. During these visits, conversations ranged from "meta" issues of American competitiveness in international markets to more specific negotiations regarding the company's participation in our study.

NESC's timing for the employee survey could not have been worse. Some of the corporations had recently gone through or were currently undergoing major restructuring. Others, severely impacted by the economic downturn, were reducing costs significantly. Still others were to announce major personnel changes which would seriously affect their employees and their morale. In spite of all those problems and the impact on their employees, all wanted to cooperate with NESC in working on this problem.

Concern was expressed by these corporate leaders about the declining achievement levels of current high school graduates especially in the critical areas of science and mathematics; the cost to the corporations of remediation; and the attendant loss of productivity. Some view the problem to be greatest at the plant floor level and its impact on American competitiveness. Most agreed with Economist Lester Thurow who cited in his latest book, The Zero Sum Solution, that the enormous gap between American and foreign workers in performance is based on education.

A number of corporations noted that they already have local programs to alleviate the teacher shortage. These local programs include "in-service" teacher training; financial, equipment and material grants; curricula supplement and teacher conference guides; sponsoring conferences and seminars; and providing volunteer teachers on a short term loan basis. Others have programs more national in scope where interested and qualified employees are "loaned out" to needy high schools and universities for periods of up to two years. Many of these corporate programs emphasize inner city schools and the predominantly black colleges.

In our search for sites to participate in the survey, NESC believed it was imperative to include locations where there were highly technical professional employees in numbers sufficient to provide a critical mass available each year upon retirement. NESC was also interested in surveying people in different industries, in different geographical locations, and in both defense and non-defense companies.

Seven corporations agreed to participate completely in this feasibility study by selecting appropriate locations and allowing their employees to be surveyed. Two who were unable to participate completely indicated a willingness to work with us on other aspects of the program.

Once the employee survey was completed, further conversations were held with corporate management to explore company policies, management attitudes and possible inhibitors to the implementation of such a program. It was found that a variety of existing corporate policies, such as tuition refund programs, could accommodate many of the anticipated needs of the teacher preparation program. The one area that stood out as a potential inhibitor was the released time required for student teaching or internship. All agreed however that on an individual basis this could probably be worked out. In most companies, the issue of such time off is at the discretion of local management; but corporate managements indicated their willingness to support local managements, as they had in the survey, to emphasize the national implications of the problem and the need for flexibility.

In addition to the meetings held with the corporations participating in the study, meetings were also held with national insurers to discuss methods by which a corporation's cost for preparing an employee for a second career in teaching might be offset. Deferred pensions and pension portability were discussed. These concepts have currently become national issues and require in-depth study. The carriers questioned whether there is really a need for such a product. Discussions with industry sources reveal that reduced pension funding is not considered a major factor in instituting a post-retirement teacher program. Cost savings in reduced pension funding will not be deciding factors.

The military is on the leading edge of technology. As primary users of high technology and the most advanced weapon systems, they have a crucial stake in the mathematics and science competency of not only their own young people, but of all of the nation's youth.

The delicate balance of supply and demand of competent youth is of continuous concern to the military leadership. The problem was eloquently discussed by Admiral James D. Watkins, recently retired Chief of Naval Operations, in a March 1986 speech to the World Affairs Council in Boston, Mass. He noted that "the 1980 manpower pool of 2.1 million youths will shrink by 20% to 1.7 million by 1990. This means the armed services, so dependent upon top-flight people, will find it increasingly difficult to attract and retain qualified young people. Improving economic conditions - coupled with leveling retention rates, and increased competition from civilian industry for bright, talented and motivated young people - have already increased recruiting pressures." Several other key points were made:

- Surveys of Navy recruits indicate that 24% of high-school graduates tested below the ninth grade reading level.
- One out of every four freshmen in high school will fail to graduate.
- Of those who graduate, many will still lack the basic skills required to master Navy technical manuals.
- Business, industry, military, and even colleges must conduct widescale and expensive remedial courses to supplement skills which should have been learned previously.

NESC was encouraged by broad evidence of the military's commitment to solving the problem.

ITEM: The Chief of Naval Operations Task Force on Personal Excellence and National Security established a program of Navy Partnerships in Education which includes a Mathematics and Science Initiative, a Saturday Scholars Program and an

Adopt-a-School Program. Navy volunteers, with experience in training and instructing technical subject matter, assist teachers at many high schools across the nation. Their support to the teacher involves tutoring, lecturing on applications being studied, setting up laboratory experiments, and grading tests. The reactions of teachers, principals and parents have been most favorable and reassuring.

ITEM: In 1983, Governor Robert Graham of Florida recognized the seriousness of the shortage of mathematics and science teachers in his state. In response, the Naval Education and Training Command initiated a pilot program in Pensacola. The first part was to identify volunteers with math and science skills willing to assist teachers by tutoring, sponsoring mathematics and science clubs, and helping in the study of computers. The second part was to identify those approaching retirement who might consider enrolling in a formal education program leading to certification and a second career as a teacher.

Out of over 400 volunteers for the entire program, about 50 expressed interest in the formal certification program. In 1984, 16 degreed professionals who were within three years of retirement began a two year, evening, teacher training certification program at the University of West Florida. To date, four have become certified and are teaching. There is consensus that a formal support system by the Navy and the University could have increased this number. There is no question, however, that the Pensacola program has proven that teaching as a second career can be made to work.

ITEM: On September 30, 1986, Secretary of Defense Caspar W. Weinberger and Secretary of Education William J. Bennett signed a formal agreement to encourage retired and retiring military men and women to seek second careers in teaching. Secretary Weinberger noted that military people have spent much of their lives leading, instructing, sponsoring young people, and organizing programs for specific purposes —— doing exactly what teachers do. They have skills in science and mathematics, much in demand in public schools. Secretary Bennett called for changes to eliminate certification obstacles that could prevent veterans from

entering the profession. The focus on "paper credentials" should be reduced through alternative certification programs, he said.

Given this commitment, we believe that the military can make a major contribution towards alleviating the nation's shortage of science and mathematics teachers. The military provides its personnel with considerable opportunities to improve their education with 75-90% of off-duty courses paid for by the military. Many are also eligible for veterans administration (VA) education benefits.

To explore the level of interest in NESC's program and to obtain the commitment of military leaders to it, NESC employed the following methodology:

- Continuous collaboration has been maintained with the Education Directorate at the Department of Defense. The Education Directorate has been instrumental in raising the awareness of the problem at all levels right up to the Secretary of Defense and has assisted NESC in assuring that the strategy for the armed services is realistic.

- Meetings were held with the Chief of Naval Education and Training and his Principal Civilian Advisor to learn about their current programs and more importantly, their opinions of our strategy. We were impressed by their enthusiasm and offer to become involved.

- NESC met with key members of the Navy's Personal Excellence staff to determine the most effective ways to broaden current programs to include NESC's strategic effort. These meetings were most productive.

- Meetings were held with top officials of the Department of the Army, to determine whether they would be interested in participating in a comparable survey of Army personnel and whether NESC's program would be of value to the Army. NESC's program was both timely and on target. It fit in quite naturally with a much broader program of Transition Management* the Army was implementing. They agreed to participate completely.

*A new program encompassing the life span of a soldier from enlistment to separation with emphasis on assisting at keypoints the transition into civilian life and the reserve component.

- Military and civilian leaders in the appropriate departments of the Army and Navy were interviewed to determine whether there would be any major inhibitors to NESC's program. The main obstacle, as with the corporations, is the question of released time for student teaching. All parties are confident however that this can be worked out on an individual location basis. The military leadership is enthusiastic about this concept and expects to make it a reality.

- Even though not a formal part of the survey, the Air Force Director of Personnel Programs and his military and civilian staffs have been briefed on NESC's program, survey and preliminary results. There is every expectation the Air Force will participate in NESC's future program.

From the many helpful meetings and comments, it was evident that the military leadership has an avid interest in the study being made by NESC and its successful completion.

NATURE OF THE QUESTIONNAIRE

An eight-page questionnaire was developed by NESC and ETS for distribution to a targeted group of professionals in industry and the military. The questionnaire was to take no more than 15 minutes to complete. Pre-testing showed it could be completed in less. The target population in the participating industries were individuals who were 45 years of age or older and who had at least one technical degree. In the military, the survey was limited to individuals with 17 years or more of active duty and at least one technical degree.

The first few questions asked were whether the respondent:

- had ever considered a career in teaching, and if so, why the idea was abandoned;
- has thought about a career after retirement, and what period of time was foreseen as being devoted to such a career; and
- would be interested in exploring a post-retirement career in teaching.

Respondents expressing no interest in exploring a post-retirement career in teaching, were directed to the demographic questions at the end of the questionnaire. Those who expressed positive or conditional interest in teaching were asked a series of additional questions that included:

- their preference of school level teaching;
- rating the importance of a list of conditions related to preparation for post-retirement teaching;
- possible qualifications for teaching (including academic preparation, past experiences, and certification status);
- perceptions of their employers' policies/attitudes related to pre-retirement preparation for teaching; and
- financial needs after retirement.

All respondents were asked a series of demographic questions, including age, sex, minority group status, current annual salary, length of employment with their present organization, several questions about the nature and field of their current work assignment and details of their university degree (s) and fields.

The questionnaire was reviewed by numerous individuals, including representatives of the organizations in which the survey was conducted. As a result of these reviews, a few questions were eliminated from the questionnaire* used in selected organizations. Most of the questions, and all of the most important questions, were asked in the same form for all respondents. Where items were eliminated from particular versions of the questionnaire, the data simply show reduced numbers of responses compared to those submitted for questions common to all organizations surveyed.

Subsequent to the cut-off date established by NESC and ETS, 160 additional replies were received and forwarded to NESC. These were integrated by hand at NESC. As a consequence, the numbers in this text may vary in some instances from those used by ETS in their analysis. This difference does not however affect any major findings of the survey.

INDUSTRY SURVEY

In planning for the administration of the survey, discussions were held with human resource executives at the seven participating companies. The population of interest was defined and enumerated and each organization volunteered a specific facility that was representative of that company. In only one instance did NESC request that a facility be changed in order to achieve better geographic distribution. Each

*A copy of the general questionnaire can be found in Appendix A.

corporation developed a list of its employees meeting the survey criteria; however, this list was not made available to protect each employee's privacy. The total number of questionnaires required was then requested of NESC. ETS mailed the requested number to a designated representative at each company location. To further assure respondents' privacy, a stamped, self-addressed envelope was provided for return of the completed questionnaire to ETS. Each organization devised its own cover letter and mechanism for distribution. The letters differed in style and tone, but each described the survey and stressed its importance. A total of 6107 questionnaires were distributed. The number surveyed ranged from a low of 207 at one location to a high of 2011 at another. Response rates were similarly varied, ranging from 30% at one location to 84% at another. In all, 3402 questionnaires were returned, an overall response rate of 56%. The data for each of the organizations are presented in Table 1.

TABLE 1
SURVEY RESPONSE RATE FOR SEVEN COMPANIES

Company	Number Surveyed	Number Returned	Percent Returned
I-1	514	431	84
I-2	207	130	63
I-3	480	361	75
I-4	2,011	910	45
I-5	720	219	30
I-6	1,875	1,122	60
I-7	300	229	76
TOTALS:	6,107	3,402	56

The survey data from these seven corporations, while highly relevant, are not in a statistical sense a sampling of all American industry. Yet, as will be shown, the survey is significant in that the data reveals a substantial number of technically trained professionals, working in totally different corporations, industries, and geographic areas, who display a common interest in teaching as a post-retirement career. Important common denominators also surfaced with respect to previous interest in teaching as a career; the attraction of high school teaching; and their willingness to prepare to become qualified teachers. Of dominating importance, was the large number expressing such interests.

There were 1089 respondents who indicated an interest in teaching. Of these, all have at least one bachelor's degree, 35% a master's degree and eight percent a doctorate. In terms of specialization, engineering was the most dominant field: 462 have a bachelor's degree, 251 a master's degree and 45 a doctoral degree. A full breakdown of the degree distribution among potential teachers is shown in Table 2.

TABLE 2

DISTRIBUTION OF DEGREES* FROM 1089 POTENTIAL INDUSTRY TEACHERS

Field	Bachelor's	Master's	Doctoral	Total
Physics	81	35	9	125
Chemistry	31	13	27	71
Biology	6	4	9	19
Math	104	27	3	134
Engineering	462	251	45	758
CompSci	12	23	2	37
Other	41	109	10	160
TOTALS:	737	462	105	1304

Other highlights of the industry responses follow:

- Thirty-two percent answered "yes", they would be interested in exploring a post-retirement career in public school teaching. An additional 38% answered "It depends".
- An important characteristic of those who expressed interest in post-retirement teaching is that 53% had originally considered such a career.
- About three-fourths of those interested in post-retirement teaching were willing to take required education courses and do practice teaching if their companies would provide released time for such activities.
- Close to 90% said they would be inclined to become a teacher if certification requirements were changed to eliminate the need for education courses.

*Academic degrees are represented as the highest degree received by an individual in any field. Thus, the numbers presented are conservative estimates of the numbers of degrees across all respondents. To illustrate, an individual with a bachelor's, master's, and doctorate in biology is counted only once, as a biology doctorate. An individual with a bachelor's degree in physics and a master's degree in engineering is included in the totals for both degrees. A person with a bachelor's degree in engineering and a master's degree in business, would be counted twice, once as a bachelor's degree in engineering, and once as a master's degree in "other".

- Most of the respondents were male and white. Six percent identified themselves as members of a minority group. One percent were Black and one percent were Hispanic. Two percent were female.
- About two-thirds characterized themselves as professionals rather than as managers.
- Most claim their jobs require some degree of technical expertise, engineering the most likely.
- About 75% have been with their organizations for 20 years or more.
- The median age varies from the late forties to the early fifties.
- Asked how long they might teach, 40% said four to six years, while 30% said seven years or more.
- Most preferred teaching at the senior high school level.
- Most who express an interest in post-retirement teaching feel their companies would look with favor on their plans to teach after retirement.
- A major concern is retaining all company pension benefits. Few appear to be able to forego these benefits.
- Another concern is having a full or part-time teaching position available in their home community.
- Least important is being allowed to retire early in order to begin full-time teaching.

One disappointment in this data is the small number of women and racial minority respondents. While the above percentages are generally consistent for minorities in the science and engineering workforce, special programs may have to be created to identify and recruit more minority prospects.

MILITARY SURVEY

The military have a wealth of personnel with expertise in areas of mathematics and science. Many retire at the peak of their productive lives to pursue second careers. Most have conducted on-the-job training, and many have formally taught. In addition, they possess leadership and organizational skills developed during their service years.

There is no question that the previously cited Pensacola program has proved that teaching as a second career can be made to work. In view of the Pensacola experiment and in order to obtain data on the national population of the military, it was determined that for our survey a random scientific sampling of a targeted military segment would be the most effective way to determine the potential interest of this important group. After discussions with appropriate Army and Navy leaders, it was agreed that such random sampling could be made. The survey questionnaire was reviewed by each of the services and with minor exceptions was the same as that used by industry. It was, however, personalized by using the terms "officer" and "enlisted" as identifiers instead of "manager" and "professional".

Military statisticians, using standard criteria for such surveys, determined that to have a confidence level of at least 95%, it was necessary for ETS to receive at least 384 valid questionnaires from each of the services. Thus 700 people in one service and 650 in the other were randomly selected and sent questionnaires. The required response rate was not only met but exceeded.

As with the industry executives, the military leadership insisted on preserving the privacy of their people. Each service received from ETS the required number of questionnaires and postage-paid envelopes with the ETS address imprinted. Each service provided its own cover letter. Completed questionnaires were returned directly to ETS by the respondents. A total of 1450 questionnaires were distributed: 1350 were part of the nationwide sample and 100 were distributed among four military installations. Details of the military surveys can be found in Table 3.

TABLE 3
SURVEY RESPONSE RATE FOR THE MILITARY

Service Organization	Number Surveyed	Number Returned	Percent Returned
M1 (Sample)	700	441	63
M2 (Sample)	650	413	63
M2A	30	22	73
M2B	30	25	83
M2C	35	24	69
M2D	5	4	80
TOTALS:	1450	929	64

The response rate for the military exceeded that of the industry people by eight percentage points. This was not surprising in view of the industry environment at the time the survey was taken on one hand, and the character of those in the military on the other.

Because two groups of military respondents represent scientifically selected samples of a targeted group which exceeds 10,000 personnel, the number of respondents can be used to project actual numbers from each of the surveys.

There were 382 respondents who indicated an interest in teaching as a second career. Of these, all have at least one bachelor's degree, 42% a master's degree and five percent a doctorate. A full breakdown of the distribution of degrees among potential teachers is shown in Table 4.

TABLE 4

DISTRIBUTION OF DEGREES FROM 382 POTENTIAL MILITARY TEACHERS

Field	Bachelor's	Master's	Doctoral	Total
Physics	14	7	2	23
Chemistry	16	6	2	24
Biology	19	8	5	32
Math	32	6	1	39
Engineering	75	86	4	165
CompSci	3	9	0	12
Other	84	74	11	169
TOTALS:	243	196	25	464

Other highlights of the military responses follow:

- Forty-one percent said "yes", they would be interested in exploring a post-retirement career in public school teaching. This is almost 10 percentage points higher than industry respondents. An additional 38% said "It depends". Only 21% were definitely not interested.

- Extrapolating from the national sample described earlier, a total of 2300 Army and Navy respondents would be expected to have expressed a positive interest in teaching as a post-retirement career.

- Among all respondents, about half had once considered careers in teaching. However, among potential teachers 75% have thought about teaching as a career at an earlier time... thus, the group of potential teachers includes a high percentage who may have been interested in the profession for some time.

- Asked why they chose not to become teachers, 52% of those interested cited the appeal of the armed services, while 40% said salary was the deterrent.

- Military respondents appear to have given more thought to post-retirement careers than their industry counterparts. 60% have given a "great deal" of thought to career after retirement compared to 20% in industry.

- Most respondents are male and white. Six percent identified themselves as members of a minority group: Blacks are the most represented group in one service (2.3%) and Hispanics are the highest represented group in the other (2.2%).

- At least 90% of those interested in post-retirement teaching have taught, instructed, trained or tutored. About three-fourths have taught for a period of more than two years.

- Eighty-nine percent claim their jobs require some degree of technical expertise. This is only nine percentage points less than the industry group.

- As expected, military respondents are younger, on average, than those from industry... over 50% are under 45 years of age.

- About 70% foresee spending 13 years or more in a career after their military service. The major implication is that a sizable proportion plan to devote a considerable number of years to a second career. This can be of enormous benefit to the teaching profession.

- More than 80% of those interested in teaching prefer senior high school over other levels.

- An important factor is the availability of a teaching position near their homes. Military respondents are more interested in full-time than part-time teaching positions.

- About three-fourths of those interested in teaching are willing to take required education courses and do practice teaching if released time is provided. At the same time, 83% indicate they would be more inclined to seek a second career as a teacher if state certification requirements were changed to eliminate the need for education courses.

- Only about half of those with an interest in post-retirement teaching view teaching as a challenge that is different from their current work.

OVERALL SURVEY SUMMARY

Seventy-five hundred questionnaires were mailed and forty-three hundred were returned... an impressive 57% response rate. The key question in the survey, asked of all respondents, is the one that asks whether they would be interested in exploring a post-retirement career in public school teaching. Across all groups of respondents 34% said "yes". An additional 38% chose the "It depends" option. Only 28% indicated they are definitely not interested.

If this test group is typical of the untapped resource within industry and the military, and there is little reason to believe it is not, it would appear there is a highly intelligent, and substantial group of technically trained people who are potentially strong and viable teacher candidates. Should they ultimately elect a second career in teaching, they will require reduced training time and have normal career longevity. They would bring to the teacher ranks, a unique level of proven excellence at a minimum of cost. These advantages, taken as a whole, are available from no other source. The numbers available each year on a nation-wide basis would clearly help reduce the teacher shortage in the critical fields of math and science.

CHAPTER IV: ..... SURVEY OF PUBLIC SCHOOL DISTRICTS

In an effort to determine the level of interest that public school districts might have in hiring non-traditional second career teachers from the military and industry, NESC sent a questionnaire* to district superintendents of schools in the areas surrounding selected industry facilities of companies that participated in the feasibility study. Table 5 shows the number of superintendents receiving questionnaires and the number of completed responses returned to NESC.

TABLE 5

Area Surveyed	Number of Districts surveyed	Number of questionnaires returned	Percentage return rate
Fort Worth, TX	18	7	39
Los Angeles, CA	18	6	33
New London, CT	48	18	38
Philadelphia, PA	15	9	60
Raleigh, NC	40	14	35
Syracuse, NY	13	8	62
Wilmington, DE	9	6	67
Windsor, CT	5	2	40
TOTALS:	166	70	42

While the overall return rate of 42% was less than anticipated, the 70 questionnaires that were returned provided rich and substantial information. NESC queried a few non-respondents and learned that some felt burdened by too many surveys and other administrative requirements. In some instances, others wished to avoid controversy. Such being the case, NESC decided not to invest additional time and money to pursue a higher response rate.

Although the responses are widely distributed among districts of varied sizes, this was not intended to be nor should it be considered as a random sample. Consequently, it is not NESC's position that the data are representative of all

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* See Appendix B for a copy of the questionnaire.

districts in the vicinities of the corporate facilities nor of American school districts generally. As the NESC program is expanded to include specific pilot tests, a greater effort will be made in each instance to determine the exact need for math and science teachers in related geographic areas.

The responses from the school administrators indicate that, despite declining enrollments in most districts at the secondary school levels, there will be a need for mathematics and science teachers over the next five years. Table 6 shows the totals from the districts within a 25 mile average radius each of the areas surveyed.

TABLE 6

Area Surveyed	# of Districts Responding	Math/Science Teachers Hired Past 5 years	Vacancies Next 5 yrs	Difference
Fort Worth, TX	18	1,867	3,178	+ 1,311
Los Angeles, CA	14	952	956	+ 4
New London, CT	6	51	51	0
Philadelphia, PA	7	51	49	- 2
Raleigh, NC	8	428	540	+ 112
Syracuse, NY	9	112	139	+ 27
Wilmington, DE	6	16	17	+ 1
Windsor, CT	2	24	35	+ 11
TOTALS:	70	3,501	4,965	+ 1,464

These data confirm that school districts will continue to hire mathematics and science teachers in the near term, as well as in the future. In six of the eight geographical areas studied, the school administrators indicate that more math and science teachers will be needed in the next five years than have been hired in the past five years.

Three items on the questionnaire probed the level of interest the school administrators had in the NESC strategy. One question asked: "What are your thoughts about recruiting retiring private sector personnel who have been trained

and certified for a second career in public school teaching? " The responses were coded into three categories: positive, negative and neutral or non-committal (including those who did not answer the question). The distribution of the responses to this question is presented in Table 7.

TABLE 7

Area Surveyed	Positive Response	Negative Response	Neutral or Non-committal
Fort Worth, TX	16	1	1
Los Angeles, CA	9	2	3
New London, CT	4	1	1
Philadelphia, PA	5	0	2
Raleigh, NC	8	0	0
Syracuse, NY	8	1	0
Wilmington, DE	6	0	0
Windsor, CT	1	0	1
TOTALS:	57	5	8

As the above table indicates, the administrators in 57 of the 70 school districts that replied — an impressive 81% — expressed positive reactions to the idea of recruiting private sector personnel for careers in public school teaching; only seven percent of the sample were negative to the idea.

The respondents were concerned that the candidates be certified, knowledgeable in their subjects, and energetic. One respondent wrote that he was "positive as long as they can perform." Another indicated that "we have had some real success with a few," but that "some are without the energy needed to work with young people and others are so academic that they would have a most difficult time relating." Other representative responses were:

- Appears to be a viable, untapped source - we would be receptive to these candidates especially at the senior high school level.
- No reservations as long as they are certificated. The minute-to-minute demands of managing 25 adolescents is an experience many private sector personnel may not be prepared for.

- Good thought, if they are serious about a sound career and not a retirement position. Teaching is hard work!
- We have had positive experiences with "retreads" - they bring depth of experience and maturity.

Among the reservations expressed by those who were negative or non-committal were: lack of vacancies in the near future; need for younger people in the teaching force to balance an aging faculty; satisfaction with existing recruitment sources; and concerns about being fully certified and/or adequately trained.

Another question was similar to the one discussed above; only instead of "private sector personnel," the question focused on using "retired military personnel". The responses to this question are presented in Table 8.

TABLE 8

Area Surveyed	Positive Response	Negative Response	Neutral or Non-committal
Fort Worth, TX	15	1	2
Los Angeles, CA	8	4	2
New London, CT	3	1	2
Philadelphia, PA	5	0	2
Raleigh, NC	8	0	0
Syracuse, NY	9	0	0
Wilmington, DE	6	0	0
Windsor, CT	1	0	1
TOTALS:	55	6	9

The responses to this question are very similar to the one on private sector personnel, and almost as positive (79% as compared with 81%). The one additional reservation expressed related to regimentation or inflexibility — traits imputed to a military career. "Not good," wrote one superintendent, "most are very inflexible." Another indicated some concern about relating "the military orientation to the public school environment of today." A third respondent stated that "the military suggests regimentation. Today's schools are anything but regimented. Could military personnel make the transition?"

On the positive side, a number of superintendents had hired retired military personnel previously and/or saw military training as an asset:

- Excellent idea. We have currently two retired military personnel.
- I think they are great — well trained, well traveled, friendly and especially disciplined. Send more!
- We do it all the time because they make excellent employees.
- Many may offer different ways of looking at educational issues. Utilization of such persons could be a positive solution to recruitment problems.

The final question posed to the school administrators was the most direct: "Would your district be interested in working with us and a nearby corporate facility to pilot-test this type of program?" In response, 52 out of the 70 districts (74%) were positive, with only 9 districts (13%) saying they were not interested. The distribution of responses by locations is show Table 9 below.

TABLE 9

Area Surveyed	Positive Response	Negative Response	Neutral or Non-committal
Fort Worth, TX	13	3	2
Los Angeles, CA	7	3	4
New London, CT	4	1	1
Philadelphia, PA	7	0	0
Raleigh, NC	6	1	1
Syracuse, NY	8	1	0
Wilmington, DE	6	0	0
Windsor, CT	1	0	1
TOTALS:	52	9	9

For respondents who were positive, very little elaboration was offered since they tended to express their reasons in response to the two previous questions. The neutral or non-committal responses generally focused on cost, certification issues, or the need for more details. The negative responses were primarily from smaller districts that did not anticipate the need for any mathematics or science teachers in the near future.

In sum, the questionnaire for school districts was mailed to 166 districts surrounding eight corporate sites, and NESC received 70 responses, indicating considerable interest in and support for the NESC strategy as it pertains to retiring military and industry personnel. The data also indicate that these districts generally anticipate a need for math and science teachers over the next five years.

These responses provide encouragement for the strategy from the very people who would be the "consumers" for the finished product. The overwhelming support from school administrators for the concept reinforces NESC's initial sense that it was on the right track, and provides additional motivation to develop plans for the pilot demonstration programs.

CHAPTER V: ..... EDUCATION POLICY AND PRACTICE LEADERS

In addition to the survey of school superintendents, NESC elicited the reactions to its strategy from other key members of the education policy and practice communities. Concurrent with the industry, military, and school superintendents surveys, NESC held discussions with a variety of people affiliated with teacher organizations, teacher training institutions, policy-making organizations at the state and federal levels as well as policy analysts studying trends related to the teaching profession. The objectives of these contacts were to describe NESC's approach to all the parties, and to obtain their support. We were also interested in uncovering impediments to the effective utilization of the soon-to-be-retired national asset base.

As indicated below, the results of these conversations are encouraging and supportive. NESC has been urged to continue exploring the feasibility of its strategy.

TEACHER ORGANIZATIONS

NESC has been encouraged by its meetings with representatives of teacher organizations. Uniformly, these people have applauded the idea of addressing both the quantity and quality issues by tapping the large pool of people with scientific and technical training who are retiring from the military and from industry. It is evident that teacher organizations have substantial concerns about the impending shortage of qualified mathematics and science teachers. Further, they entertain serious reservations about existing programs for preparing people to become science and mathematics teachers — especially in urban schools. While encouraging NESC to move ahead with its study and endorsing possible demonstration projects, the representatives of teacher organizations did offer the following suggestions:

- Second-career teachers should be well-prepared and certified.

- The experimental nature of the project provides a good opportunity to develop some alternative programs and practices in teacher preparation and in the induction process for new teachers. These prospective teachers are an elite group of mature, experienced and knowledgeable individuals. The kind of program provided for them ought to reflect this.

- "We don't want 90-day wonders," commented one person who was interviewed.

- Upon completion of their certification programs, second-career teachers should be prepared to compete for established, full-time or part-time positions in school districts. No special positions should be created for them, and they should not under any circumstances displace regular, certified teachers.

- Second-career teachers should be sure they have the energy to cope with the strenuous demands of teaching. It is important they be exposed to and become familiar with the realities of today's classroom before making a final commitment to the teaching profession.

- The possibility of team teaching or sharing assignments on a part time basis with other second-career teachers was encouraged.

- The enormity of the teacher shortage in math and science suggests that some additional approaches need to be developed ... there may be even more who with appropriate preparation could become adjunct teachers, resource people, and play other teacher support roles. Here is an opportunity to support the restructuring of the schools by developing this considerable resource in a critical area.

TEACHER TRAINING INSTITUTIONS

In discussions with the faculty and administration of teacher training institutions as well as with the leaders of their organizations, NESC received support for its proposed strategy. Many of these higher education people had positive experiences working with older, more experienced students and looked forward to the opportunity to develop new programs for them, provided the initiative came from an institution such as NESC. Especially for teacher training institutions with

declining enrollments and/or under criticism for low standards, the NESC approach could attract new students and provide the incentive for new training models.

Not all the teacher educators were enthusiastic. For some, this new breed of student could pose serious threats to their current programs. A number of undergraduate teacher training programs are already on the defensive as a result of recent reports from the Holmes Group, the Carnegie Forum on Education and The Economy, and other national groups that have criticized teacher education. These institutions will probably resist the opportunity to develop experimental and/or compressed programs for mature adults even though doing so would provide a significant new tuition source without commensurate costs.

Among those with whom the NESC program was discussed, one chairperson was particularly supportive. She saw few problems in structuring a special program for employees still working and, assuming corporate support, it would be easy to take the program to their workplace. The use of affiliate urban high schools, where a teacher candidate might teach evenings, was seen as possibly one way for meeting the student teaching requirements.

A dean of professional studies also was enthusiastic and volunteered to develop a sample core curriculum. He ventured that one practical approach would be to assemble a group of 15 to 20 candidates and build the curriculum together.

The Executive Director of an affected association offered to work with NESC to bring together 10-12 Deans from across the country to discuss the development of a sample core requirement that could be a model for an alternative approach. Corporate sponsors funding local programs have supported this approach and have volunteered the services of the Deans of their sponsored programs.

The Dean of another school of education, while extremely short-handed and somewhat skeptical that many retirees, after a long career, would be willing to

put in the work required to become certified, still thought that it would be possible to develop a special program for second-career teacher training. The approach would include: (1) intern mentoring - which is currently supported by teacher organizations but has no state or federal funding and, (2) affiliated high schools - where an opportunity would be provided to integrate the expertise of the schools with that of the colleges. Working back and forth, pedagogy and classroom experience could complement each other while building stronger relationships.

NESC has also talked with educators involved in teacher center consortiums and other school-based preparation programs. As one might expect, these people have been extremely supportive of NESC's efforts. These centers have great potential to serve as a "delivery system" for preparation programs, especially in states where alternative certification programs are in place or being considered. They can also work with new teachers to insure a smooth transition into the school system. While not yet providing sufficient course work for complete certification, teacher center consortiums, working closely with teacher training institutions, could be of great help in preparing technical professionals for careers in teaching upon retirement.

POLICY-MAKERS AND POLICY ANALYSTS

The policy framework for teaching is changing rapidly, especially at the state level, and NESC has tried to keep abreast of these changes. NESC has been in touch with staff members of the National Governors' Association, Education Commission of the States, the Carnegie Forum on Education and The Economy, the National Association of State Directors of Teacher Education and Certification, and the RAND Corporation.

Conversations with people in those policy-related groups have been very encouraging. They have generally felt that the strategy NESC is pursuing is consistent with major policy developments already underway or anticipated (e.g.,

alternative certification, new strategies for recruitment, upgrading standards, clinically-based preparation, etc.). At a recent National Science Foundation hearing, interest was high concerning an accelerated teacher training program. Comparisons were made to the success of the officer training program during World War II. Some even spoke of the education crisis as requiring war-like mobilization.

NESC also talked with state and federal officials, both to get their reactions to NESC's plans and to find out what is being planned at their respective levels. On the Federal level, Title II of the Education and Economic Security Act of 1984 (PL 98-377) has made funds available this past year to train both "new recruits" and current teachers. Another related legislative effort was U.S. Senate Bill 290 and U.S. House of Representative Bill H.R. 817 which would provide tax credits to employers who either pay pre-college math or science teachers in the summer months or release employees for teaching at a public school for at least 10 hours a week. Support for these bills was deferred pending tax reform. Now that tax reform has passed, NESC expects these bills to be reintroduced. There is a school of thought that opposes subsidized summer employment for teachers on the grounds that industry would be able to more easily siphon off the better math and science teachers. Others minimize this potential risk and favor the action. Industry's view is that it would be self-defeating to recruit these summer employees and some currently offer summer employment without the tax benefit.

Reference was also made to a Clayborn Pell bill which would appropriate 100 million dollars, mainly through the states, to improve the teaching of math and science. This bill has passed both House and Senate and awaits a conference committee. Aside from these two bills, we have discovered little of Federal policy import that affects NESC's program.

On the other hand, there are tremendous and varied actions taking place at the state levels. For example, as of July 1983, 33 states have initiated or considered some kind of incentive program to attract new teachers into science or

mathematics. By now this number must have surely increased. Today, 16 states now have provisional and/or alternate certification in effect. More have emergency certification or even worse, assigning teachers to subject areas in which they are not qualified. Others have loan programs, forgiveness programs, special scholarships and even overseas recruiting. We have begun to track developments in particular states so that we can factor in the state policy environment as we begin to identify pilot sites for our follow-on program.

CHAPTER VI.....CONCLUSIONS

This study has documented the existence of a significant pool of individuals with the technical background, interest, and at minimum, partial qualifications to become science and mathematics teachers. It clearly indicates that a teacher recruitment and preparation program for industry and military personnel is both worthwhile and feasible; and while not without problems, is achievable. The goal to insure a continuous supply of mature, well qualified teachers for the secondary schools of our country can be attained. The infusion of talented alternatively trained and experienced teachers will result in new energy and enthusiasm in our schools, improved curriculum competence, and ultimately an improvement in the quality of instruction provided students.

All the ingredients for success are at hand. We must now turn strategies into plans and plans into action. A means must be developed by which the transition from industry and military employment to the classroom can be smoothly achieved at both the policy and program levels.

A national collaborative effort is required to provide a long-term solution to this serious shortage. American industry and the armed services must adopt a post-retirement teacher option policy and institutionalize a mechanism for its implementation in both management and personnel practices. Educators nationwide need to make available education training programs that are both innovative and compressed. Where applicable, state legislators, policy makers and accrediting bodies must follow those states that have already initiated alternative certification programs. Teacher organizations must recognize this enormous potential and embrace the accelerated induction process for experienced and knowledgeable aspirants.

These actions will assure continuity, unlike earlier programs, and generate an annual stream of qualified teachers. Over time, this new breed of teacher will be accepted as readily as one trained in the traditional manner. The synergistic effect of close cooperation and knowledge transfer has the potential for improving and elevating both groups of teachers. Ultimately, distinctions will disappear. This program has the potential to rejuvenate the cadre of science and mathematics teachers for the future.

ACKNOWLEDGEMENTS

We are deeply grateful to the more than 4300 professionals from industry and the military who took the time to respond to the NESC survey, providing us with much vital and heretofore unavailable information. We are equally grateful to the 70 district school superintendents and their staffs for replying to our questionnaire and sharing their views and experiences.

Our appreciation also goes to the top leadership of the seven participating corporations, of the U.S. Army and of the U.S. Navy, and their staffs, for taking an active interest in this national problem and contributing to the success of our effort. Encouragement from The Business Roundtable was also most welcome.

This NESC study could not have been done without the substantive contribution of the Educational Testing Service, to whom we are much indebted. Our thanks to Gita Wilder and Richard Coley for their experienced advice and counsel in developing the survey questionnaire and for their astute analysis.

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EMPLOYEE QUESTIONNAIRE

APPENDIX A

SURVEY OF INTEREST IN
POST-RETIREMENT CAREERS IN
PUBLIC SCHOOL TEACHING OF MATH AND SCIENCE

I. CAREERS IN TEACHING

1. Did you ever consider a career in public school teaching? (CIRCLE ONE NUMBER)

   1. I was a public school teacher at one time.
   2. Yes
   3. No (GO TO QUESTION 3)

2. To what extent was your decision not to enter teaching based on each of the following considerations? (CIRCLE ONE NUMBER ON EACH LINE.)

	A major consideration	A minor consideration	Not a consideration
a. Family influence (parental or other)	1	2	3
b. Salary	1	2	3
c. Prestige of the teaching profession	1	2	3
d. Attractiveness of the corporate sector	1	2	3
e. Requirements of certification	1	2	3
f. Perceived bureaucracy or lack of discipline in public schools	1	2	3
g. Other (specify) _____	1	2	

3. To what extent have you thought about a career after retirement?

   1. Not at all
   2. A little
   3. To some extent
   4. A great deal

4. What period of time do you foresee devoting to a post-retirement career?

   1. None
   2. 1-3 years
   3. 4-6 years
   4. 7 years or more

5. Would you be interested in exploring a post-retirement career in public school teaching?

   1. Yes
   2. It depends
   3. No (GO TO QUESTION 20)

6. What school level would you prefer?

   1. Senior High
   2. Junior High
   3. Elementary School

7. If you have any interest at all in teaching math and science as a post-retirement career, how important would each of the following factors be in influencing your decision? (CIRCLE ONE NUMBER ON EACH LINE.)

	A very important factor	A moderately important factor	A minor factor	Not a factor
a. The company would permit you to take time off with pay for activities required for certification.	1	2	3	4
b. A full-time teaching position would be available in a school system near your home upon retirement.	1	2	3	4
c. A part-time teaching position would be available in a school system near your home upon retirement.	1	2	3	4
d. You would be allowed to retire early so that you could begin full-time teaching.	1	2	3	4

	A very important factor	A moderately important factor	A minor factor	Not a factor
e. You would retain all company retirement benefits in addition to the pay you receive as a teacher.	1	2	3	4
f. Management would support preparation for teaching as a high priority.	1	2	3	4
g. Your company work responsibilities would be accommodated so as to free some time for training and preparation for teaching.	1	2	3	4
h. You would not lose opportunity or status in the company if you were involved in a teacher preparation program.	1	2	3	4

8. Look over the list again. Which of the factors is the most important to you?

   Enter the letter of that factor here: ☐

9. Have you ever taught, instructed, trained or tutored in any setting?

   1. Yes

   2. No (GO TO QUESTION 13)

10. Describe the circumstances under which you taught, instructed, trained or tutored.

11. What subject(s) have you:

    a. Taught _____

    b. Instructed _____

    c. Trained _____

    d. Tutored _____

12. How long have you taught, instructed, trained or tutored altogether?

1. Less than a year

2. 1 to 2 years

3. More than 2 years

13. Are you now certified to teach in any state?

1. Yes State(s) _____

2. No (GO TO QUESTION 15)

14. In what subject(s)/area(s) are you certified to teach? (CIRCLE ALL THAT APPLY.)

a. Biology

b. Chemistry

c. Physics

d. General Science

e. Earth Science

f. Mathematics

g. Other

15. To become certified to teach, states normally require one to take several "education" courses and do practice teaching. If your company provided release time, would you be willing to undertake these activities?

1. Yes

2. Not Sure

3. No

16. If state certification requirements were changed to eliminate the need for education courses, would you be more inclined to seek a second career as a math/science teacher?

1. Yes

2. No

17. Indicate the extent of your agreement or disagreement with each of the following statements by CIRCLING ONE NUMBER ON EACH LINE.

	Strongly Disagree	Disagree	Agree	Strongly Agree
a. My company would look with favor on my planning to teach after retirement.	1	2	3	4
b. I have heard too many discouraging things about the teaching profession to want to teach.	1	2	3	4
c. Early retirement is not encouraged in my company.	1	2	3	4
d. At my company there is a negative attitude towards wanting a teaching career after retirement.	1	2	3	4
e. Using work time to prepare for a teaching career after retirement would hamper my chances for advancement in my company.	1	2	3	4
f. My pre-retirement development as a teacher would enhance my value to the company.	1	2	3	4
g. Post-retirement teaching would give me an opportunity to do something socially useful or to "pay back."	1	2	3	4
h. Teaching after retirement would challenge me in ways completely different from anything in my company work life.	1	2	3	4

18. When you retire, would you need your full pension in addition to a teacher's salary to meet your financial needs?

1. Yes

2. Not Sure

3. No

19. If it were possible, would you defer taking your full pension?

1. Yes

2. Not Sure

3. No

20. Some people are interested in public education but not in the teaching role. Would you be interested in working in any of the following non-teaching capacities on a part-time basis? (CIRCLE ONE NUMBER ON EACH LINE.)

	Yes	No	Don't Know
a. Assisting a teacher	1	2	3
b. Administrator	1	2	3
c. Extracurricular activities with students	1	2	3
d. Tutoring students	1	2	3
e. Career or occupational counseling with students	1	2	3
f. Curriculum development	1	2	3
g. College placement counseling	1	2	3

II. THESE QUESTIONS ARE INTENDED TO DESCRIBE YOU.

21. Age

1. under 45

2. 45-50

3. 51-55

4. 56-60

5. Older than 60

22. Sex

1. Male

2. Female

23. Are you a member of one of the following minority groups?
YES____ NO____ If YES, please circle one.

1. American Indian or Alaskan Native

2. Asian or Asian-American

3. Black/Negro

4. Spanish-surnamed

5. Other (Specify) _____

24. What is your current annual salary?

1. Less than $40,000

2. Between $40,000 and $49,999

3. Between $50,000 and $64,999

4. $65,000 or more

25. How long have you been employed with your company?

1. Less than 10 years

2. Between 10 and 20 years

3. More than 20 years

26. Which of the following best describes your position?

1. Professional

2. Managerial

3. Other (Specify) _____

27. Are you working in a position that requires technical expertise?

1. Yes

2. No

28. If yes, does the position require background in:

a. Science

b. Mathematics

c. Engineering

d. Other (Specify) _____

29. What degree(s) have you earned, and in what subject area(s)? (CIRCLE ALL THAT APPLY.)

	Bachelors Degree	Masters Degree	Doctors Degree
a. Physics	1	2	3
b. Chemistry	1	2	3
c. Life Science	1	2	3
d. Mathematics	1	2	3
e. Engineering	1	2	3
f. Computer Science	1	2	3
g. Other (Specify) _____	1	2	3

THANK YOU FOR YOUR COOPERATION

Please return the questionnaire in the envelope provided, or to

NESC SURVEY
08-R
Educational Testing Service
Princeton, NJ 08541

DISTRICT SUPERVISOR QUESTIONNAIRE

APPENDIX B

SURVEY OF INTEREST IN POST-RETIREMENT CAREERS IN PUBLIC SCHOOL TEACHING OF MATH AND SCIENCE

National Executive Service Corps
622 Third Avenue
New York, New York 10017-6753
Attention: MST Survey

QUESTIONNAIRE FOR SCHOOL ADMINISTRATORS

1. Name/city of school district _____

2. Name of person completing questionnaire _____

3 Title of person completing questionnaire _____

4. Telephone number ( ) _____ Student enrollment in district _____

5. Number of teachers in grades 7-12 _____

6. How many secondary teachers have you hired in the past five years in the following fields?

   Mathematics _____; Biology _____; Science _____; Chemistry _____;

   Physics _____; Other Science _____

7. How many secondary teachers do you anticipate needing over the next five years in the following fields?

   Mathematics _____; Biology _____; Science _____; Chemistry _____;

   Physics _____; Other Science _____

8. What is your preferred source of teachers to fill vacancies in the areas of secondary school science and mathematics?

(Over Please)

9. What colleges or universities in your area have you worked with in the pre-service and/or in-service education of teachers?

10. In general, what are your thoughts about the feasibility and desirability of recruiting retiring private sector personnel for a second career in public school teaching?

11. In general, what are your thoughts about the feasibility and desirability of recruiting retiring military sector personnel for a second career in public school teaching?

12. Would your district be interested in working with us and nearby corporate/military facilities to test this type of program?

We would appreciate very much receiving your reponse by 1986. Thank you for your cooperation. Please return this questionnaire in the enclosed envelope to:

National Executive Service Corps
622 Third Avenue
New York, NY 10017-6753
Attention: MST Survey

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APPENDIX C

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